ABOUT RENEWAL IN MEDICINE

OF

CONCENTRATED CHEMICAL RADIATIONS

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COPENHAGEN

GYLDENDALSKE BOGHANDELS FORLAG

FR. BACCES BOGTRYKKIRI

1896

ON USE IN MEDICINE

OF

CONCENTRATED CHEMICAL LIGHT BEAMS

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PREFACE.

In this Dissertation I give a Description of one Method which I have trained for the Application of Light chemical rays especially in skin pathology. Only as a clean Appendix and to further illustrate the Method provides I, also a preliminary Notice of its Use at Lupus vulgaris.

To facilitate understanding and save long descriptions the Dissertation is provided with some Reproductions after Photographs.

In an area like this, where you have to work with so many new and unknown conditions, could there of course, more and more comprehensive searches than those I have made. This is me quite Of course, but not everything can come at once.

I started my experiments in Nov. 18 ^ 5 paa Copenhagen Electrical Central Station, whose Laboratory by the then Operations Manager, Director Windfeld Hansen with the greatest amiability was nominated my Disposition, and where I met the greatest Benevolence and Interest in d'Hrr. Engineers.

As the experiments soon proved very promising,
I reached - valuable supported by d'Hrr. Professors
Reisz and Haslund - Supports of the Classenske
Fideikommis paa 500 Kr. and by the Ministry of Culture on
800 Kr. But as extensive experiments as there should be
Attempts that would cost a lot of money for premises,
expensive Lindser, Appliances, electric Light m. m. var
however, it is far from possible to hire with the help of these
Supports. Then I turned to Mr. Civil
representative, Director Hagemann and presented the Case
for him, not only that Experiments should be
largely by this method, but also,
that there was every reason to believe that
much is achieved in various medical fields by
use the Light as a Cure, but that it
The first condition for this was that knowledge was
scientific studies of the effects of light on
The organism.

I immediately managed to win Director Hagemanns
Interest and faith in the matter, and by his initiative stepped
then a circle of men together as everyone had
Willingness to support the Assignment indicated here; I mention
with gratitude the names of these gentlemen: Mayor
Borup; Professor, Dr. with. Chievitz; Professor, Over-
doctor Feilberg; Justitsraad, Hospital Inspector Gredsted;

Professor, Dr. med., Chief Physician Haslund; Factory owner, cand. polyt. Vilh. Jørgensen; Manufacturer Juhler; Pro-Professor Dr. with. Carl Lange; Engineer Niels Mogensen; Professor, Dr. with. Carl Jul. Salomonsen; Raadmand Wassard; Lighting Director Windfeld Hansen.

With these Gentlemen as the Board of Directors and Mr. Mayor Borup as Chairman of this, is there

now (in Oct. 18%) under Name of „Finsens medicinske Lysinstitut "founded a public Institution, whose Task according to Article 1 of the Statutes is: “to employ and promote studies on the effect of light on living organisms, mainly for the purpose of use Rays of Light in the Service of Practical Medicine. "

The Institute, which is managed by me with Assistance in economic and administrative Regard of Mr. Judicial Council Gredsted, has its premises in a building as in the course of The late summer has been built in an enclave in the munehospitalets Gartnerhave. Sir. Mayor Borup had, subject to the conditions necessary, granted the valuable Permission that this Reason early had to be used for this and that the Municipal Hospital supplied electrical power to the Institute, in return for this to On the other hand, the treatment of patients as of The chief physician of the municipal hospital may have to stay referred to it.

While Haab dared to nurture that from
some Fund for Scientific Purpose or
possibly from the Public, in the course of time would be able to
Money is available for the establishment of the institute and the construction of the building.
guidance, they became the necessary means in this respect -
in order not to delay the Promotion of the Case - immediately with great
Liberalism asked for Dispositio n of d'Hrr. Manager
Hagemann and Factory Owner Vilh. Jurgensen.

The building is built according to Drawing and under the Management of
Sir. Architect Tvede. Mr. Lighting Director Windfeld
Hansen and Engineer Karsten have been in charge of the technical
stallations. All these Men have kindly rendered the Institute
this Help without Remuneration. The building was taken into use
i Begyndelsen af August d. A .. og jeg har altsaa siden

that time has been able to work and will in the future have
equality to work under the best possible Conditions.
One half of the building is designed for Labora-
thorium - to whose Supply of Instruments and Apparatus
rates The Carlsberg Foundation has granted DKK 2,500. - in it
second Half treated Patients. This intimate For-
Unification of Scientific Studies and Practice is
particularly necessary in this area.

As a very important thing, I still have to add that a Support which has been granted to me on the Finance Act, has contributed significantly to that I have been able to spend all my time on these searches.

For all the extraordinary Velvillie that is herewith show me and all the significant Help I have received, I hereby biinger each my deeply felt Thanks. Most of all, though, I owe d'Hrr. Manager Hagemann and Fabrikejer Jørgensen, because not alone pecuniary side of the matter, but also the largest work at the formation of the Institute of Light is borne by them.

Sir. Professor Haslund, who has shown my Experiments the greatest Interest and as with his great Expertise has provided me with the most significant support and cheering, I bring a special Thank you.

Copenhagen in Nov. 1896

Niels R. Finsen.

Ge

Rentagne Times I have by various Articles, especially in Hospitalstidende, had the opportunity to draw Attention to the great importance of light so-called chemical rays (the blue, violet and ultra-violette), have for the animal Organism, and I have sought to show that in these Rays we have a Natural Power of considerable Strength, which one should give more Attention on and take more account of in medicine than hitherto. In particular, I have dwelled on the effects of these rays on the skin 1), their relation to the pigment formation, but especially by the Inflammation caused by them, and as in certain cases, e.g. in smallpox, has such an extraordinary significance that one knows that exclude them from the Hospitals, i.e. by filtering The light through red glass or red curtains can avoid go the suppuration of the vesicles with those flowing therefrom Disadvantages, o: the Dangerous Suppuration Fever, Scarring and the frequent sequelae-). - How strong and where

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') Finsen: About, The Effects of Light on the Skin. Hospitalstidende

o July 1893.

*) - • On the Harmful Impact of the Chemical Beams on it

Animal Organism. Hospitalstidende 1. Nov. \ S9'.i.

crucial this Effect of the chemical Rays is for
The transition of smallpox eczema into pus formation will be best
appear from the results obtained by this treatment.
tater. There is now, as far as I know, in the literature
Minutes of c. 70 thus treated smallpox cases, and
of them, the method has only in one case failed 1).

That the light exerts a certain influence directly on
The blood is detected by the observation I have
caused the red blood cells to contract at the light source.
influence.

Furthermore, I have by a number of experiments 2)
demonstrated an inciting effect of these rays on
Nervous system, an effect which in various lower
Animals and fetuses are so extraordinarily strong that the
doubt must have its great significance. Herewith is also
proved that the Life and Movement observed
takes in so many animals (eg reptiles and insects),
when the sun shines and especially when it suddenly
breaks out, mainly due to the chemical rays
and not, as has hitherto been assumed, the Heat and
The light.

However, it is another no less important
full effect of the light, which I will get into here,
namely, the effect on microorganisms. Here has
one the charitable Feeling - as opposed to by
other questions of light - to be in a care-
equal and well-worked field, thanks to our Age
great interest in the small organisms.

') Finsen: The red light treatment of smallpox. British medical

journal 7. Dec. 1895
') -: Lyset som Incitament, Hospitalstidende Nr. 8 1895.

Effect of light: on microorganisms.

After that by numerous Studies especially of
Downes and Blunt, Duclaux and Arloing had been established,
that the Light had an inhibitory and after sufficient
Time lighting a lethal effect on bacteria,
sought to further determine this Effect. IN
Initially, there was some divergence between the

various researchers, but in recent years one is at
improved Methods and greater Accuracy in the Experiments
come to fairly clear and consistent Results.
In particular, in recent times, the use of surface-
Cultures to these Attempts (Buchner) effected a great
Progress, using the previously used Mass Cultures
had the disadvantage that they were furthest or deepest
Layers were less affected by light than those
In addition, reagents were generally used.
glass or flasks, which must be absolutely unfortunate
Due to the refraction of light in the curved glass.

Since there is such a rich literature over
this subject, I can not go into the individuals
Authors' Studies, but will in brief
give what one must consider to be fairly established
in this area and what is of interest
us here.

As the most important Questions I will mention: 1) Where
long-term exposure to light is necessary to kill
The bacteria? 2) What does this Effect consist of? 3) Which
Parts of Light D: what spectral beams cause it
Effect?

How long is needed? In almost everyone
the first Series of Surveys are about long

Period - many Hours, until several Days, Weeks, yes Months - before the Light had killed the Cultures. One-Celtic researchers even came to the conclusion that the light not killed Bacteria. In the Application of Plate Coal trips (Minck and Buchner 1), Dieudonné *)), it has it turned out that there was no need for nearly that long. Dieudonné found that direct sunlight in the summer months manages to kill Kimene after only 1 - l 1 / «Times For-run, diffuse Daylight after c. 5 Hours, electric Light (Arc-lamp at 900 Normallys) after 8 Hours, and Incandescent after 11 Hours 3). The Bak- used for these Experiments terier item: Ant. prodigiosus, Bac. fluorescence and for a Part of the Experiments Regarding Bact. coli com. Typhoid Bacillus and Anthrax. To inhibit growth was about half the time needed. - These are latest Time Indications are probably the shortest, man know.

What does the effect consist of? Most have taken an effect on the bacteria themselves. Roux i) has however, experiments with anthrax have shown that the effect of light on the nutrient material (broth) also had a certain Meaning, so that spores which were sown in Broth, immediately after it had been exposed

3-4 Hours for Sunlight, did not grow out; were killed

') Buchner: On the influence of love on bacteria and iiber

the self-cleaning of the rivers. Archiv f Hygiene Bd. XVII 1893

S. 179.

-) Dieudonné: Beitråge zur Beurtheilung der Einwirkung des Lichtes

on bacteria. Work from the Imperial Health Office

Bd. IX S. -405. 1894

*) See my Critique. S. 30.

4) Roux: From the action of light and air on the tracks of the

bacteria of the carbon. Annal, de l'Institut Pasteur 1887 Nr. 9. S. 445.

they did not, for when they were brought into a not

insulated broth, they grew well. Vegetation

forms of anthrax, however, did not

that the Bouillon had been exposed to Light, they grew in it as well as in other Bouillon.

.Regarding the External Conditions as should be present for the Light to be able to kill Bak-Territories, it seems to the authors of various searches to show that the presence of oxygen, is of greatest Significance, therefore one has, and presumably with Right, talked about that the effect on the bacteria closest was an Oxidation. An even more definite View was submitted by Richardsott 1) and DieHdotuié *), namely the that the effect of light is due to the formation of hydrogen peroxide (H_2O_2). This Assumption is supported, among other things. a. thereby, that they are the same kind of light rays which form the hydrogen hyperoxia, which has a lethal effect on bacteria.

What Spectral Beats Cause This Effect? I can be brief about this, because there are among the various Investigators roughly Agree that the most fragile rays are the most important tigste and the least fragile have little or no Impact, some Authors are even almost inclined to grant the Red Color a favorable Influence

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') Richard son: The action of Light in preventing Putrefactive Decomposition; and in inducing the Formation of Hydrogen Peroxide in Organic Liquids. Journ. chem. Soc. 1893 p

'-') Dieudonné: L'ber die Bedentung des Wasserstoffsuperoxyds fur the bactericidal power of light. Works from the Kaiscr-lichen Gesundheitsamte Bd. IX S. 537. 1894.

on the growth of bacteria. Virtually all attempts show that the blue and violet rays have the strongest Effect. While some Investigators have found strong Effect of the ultraviolet rays, others have found them more indifferent. The green rays are added as a rule, a weak inhibitory effect.

By Authors Who Have Examined This Relationship I would like to mention in particular: Downes and Blunt 1), Geisler '2}, Buchner '6), Dieudonné i), Janotvski 5), d'Arsonval og Charrin 6).

There is one more important question left: Can Light Kill All Bacteria? and if it can, are they all equally resistant to the Light?

On the first question can be answered that it seems according to the exceedingly numerous studies on much different Forms, partly mixed Cultures (Downes and Blunt), partly Reindeer Cultures (most later Investigators) to be a common property, at least for the pathogens Forms that they are killed by the Light (the pathogenic Forms have, as one might expect, been particularly frequent Subject of Study). That there are Exceptions

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') Downes and Blunt: Researches on the Effect of Light upon Baeteria and other Organisms. Proceedings of the Royal Society of London Vol XXVI 1877 S. 488.

2) Hostage: To the question about the effect of light on bacteria. Centralblatt f Baktenologie Bd. XI 1892. S. 161.

3) Buchner: 1. c.

4) Dieudonnc: 1. c.

5) Janowshi: On the Biology of Typhoid Bacilli. Centralblatt! '. Bakteriologie Bd. VIII S. 167 1890.

B) of Arsonval and Charrin: Influence of atmospheric agents, en particularly of the Enlightenment and the cold, on the pyocyanic bacillus. La Semaine médicale 1894 S. 26.

from this Rule I will, however, mention, as Eugelmann 1)
have found that some Forms (Purple Bacteria) favor
The light, (which, however, probably only applies to a certain degree).

With regard to the second question: about all
Bacteria are just a little resistant to Light,
the answer will be more difficult. So much can be said that
it seems to be a Rule here - just like opposite
other bacteriocidal Agents - that Yegetationsformerne
succumb more easily than Spores. DuJaitx ") has
also believed that Chefs were less resistant
skilled than Bacilli, but this does not seem to be
been confirmed by other Investigators. With Consideration
to the Resistance of the individual special Forms
nothing definite can be said, the difference being
The time indications of the various Investigators a lot
may have its reason in different ways of creaming
and in particular different Brightness. Any Difference in Counter-
resilience is not generally mentioned by the
the seekers, so that one can probably assume that it does not
is big. Closer Inquiries above this would, however
be of great Interest.

To my Experiments, which would be mentioned later,

I have as a rule used m. prodigiosus, partly because
it is comfortable to work with, and partly because it
has been frequently used by other Investigators and
compared with other forms, so that one knows about
the that it forms no Exception, neither in
one or the other Direction.

') Eugelmann: About bacteriopurpurin and its physiological

Meaning. Pllugers Archiv Bd. 42. S. 183.

'-') Duclaux: Influence of the light of the sun on the vitality of micrococcus. Compt. rend. Aug. 1885. T. CI.

The Practical Use in Medicine of Light

Bactericidal Effect.

Due to this bactericidal ability has
Sunlight, of course, an Extraordinary Significance in Nature,
I mention here merely that the rivers and lakes interesting
Self-cleaning for Bacteria without a doubt is due to Solthe light (Buchner) ').

A Direct Use of Sunlight as a Disinfectant remedy is also very common, it is after all especially of this reason that one strives to provide such bright dwellings and especially as bright bedrooms as possible; man "soler" Bedding, etc. This Last Use, Sold Disinfectant which has been scientifically studied by Esmarch 2), however, does not last as long as it promises, especially because The light, especially with colored substances, does not manage to penetrate in depth, but only affects the surface and that only in the places directly struck by the Light.

It is quite different, however the living tissues, these are as known, and as I later will get closer to, very permeable for the Rays of Light. In addition, the Light can penetrate The body without damaging the skin. The latter is one priceless quality, a quality which, as far as I know, no other bactericide is in possession of 3).

') Buchner 1. c.

'J v. Esmarch: Uber Sun Disease. Journal of Hygiene. Bd. XVI, Issue 2, 1894.

s) When there is talk of rays penetrating the body, think for the time being first and foremost on the so interesting X-rays

Rays, and since there have also been some - American Stories that these Rays could kill various pathogenic Bacteria, one might think I do not have The right to award the Light Beams one of these properties.

We now see, therefore, that from a theoretical point of view it is there is nothing in the way of, on the contrary, everything speaks for a light, by local, superficial, bacterial Skin Disorders.

This Use of Light, as in Reality is so close, however, is virtually unknown in medicine, at least with the Motivation I have given here. The Few Cases I Have Found Mentioned in the Literature applies to all The treatment of Lupus. In Tillmanns Surgery (4th ed. 1895 p. 443) the following Passus is found: “Thayer recommends the Destruction of Lupus by Help of Soll ys, collecting the Sunbeams with a Burningglass and let them work in the lupus places. Firethe wound heals well and quickly. "The original account I do not know; but it seems as if it is Sol-
The heat effect of light that Thayer wanted to apply. For the sake of completeness, I would like to mention that I

has also seen the same way of treating lupus mentioned in a recent book by OtterbetH (Die Heilkraft des Sonnenlichtes 1896 S. 101), han meddeler, at he was once consulted by a Lupus patient, who had been treated by a layman with sunlight collected by Brændglas' I.

Finally, there is a report by Ziegelroth

However, I base my opinion on some studies of Berion announced in the Académie des sciences July 13 18% (Ref. I the Sem. medical July 22, 1896 S. 283). Berion had procrastinated Cultures of Diphtheria Bacillus for 16 Hours, 32 Hours and 64 Hours before the X-ray rays without being killed or weakened.

') After the parts have been written, a bad booklet has appeared: Meins Sonnentherapie af iiaximiliatl liéhl. The author who is Layman, hat just used this Maade.

(Blåtter f. Klin. Hydrotherapie, Juni 1895 S. 138) om, at Dr. Lahmann (Naturopath, Head of Sanatorium Weisser

Millet at Dresden), has treated two Lupus patients with electric light. Simultaneously with the lighting, the wounds became sprayed with a "needle-sharp" water jet, alternating cold and hot, so that there was often bleeding. Dr. Lahmann's motive for this treatment was very much right that the Light manages to kill Bacteria. Organizer ning was as follows; he used a 12 Amperes electric arc lamp, which was placed in the Focal Point for a parabolic Mirror (c. 3/4 Meter from the Mirror). The mirror thus emitted parallel beams (but concentrated not the Light); for these Rays the Patient was exposed in a Distance of c. 1 Meter from Lysbuen and c. L 3/4 Meter from The mirror. In the Beginning, the Patient was exposed for 10 Minutes, later V 2 Hour daily for the Light. - As I already have said, The motive for this Treatment was very excellent, but when we consider that the light used here and on the way it is used is hardly stronger than the general amiable daylight, and must be assumed very soon after 4 - 5 Hours Course to be able to kill Bacteria, then sounds it most strange not to use a stronger Word, to expose a lupous wound for 10 minutes to this light. If such a light could have a destructive Effect on Lupus, would it e.g. be complete impossible to have lupus on the face, as the sunlight hair saw rich opportunity to work on.

These individual Stories of the Use of Light at Lupus are as proved not very valuable and could not well form the Basis for further Attempts, soon one could then learn from them how not to carry on.

The case itself is not that difficult, but However, the road is long enough, and the experiments many, before one runs the Right. It's now a year ago, me began my experiments, but now I also think that it Method I have found and further trained is a lot usable. One can with the help of this on one easy and for the patients not uncomfortable way in fully Measure apply the bactericidal of Light Force as indicated above, o: at local, overflat, bacterial Skin disorders.

My Attempts fall essentially into two Departments 1) Subsearches with regard to the Use of the Light and 2) Investigations of the penetration of light into the tissues. As a third Department joins this a preliminary Communication on the Application of the Method in Practice.

I. Studies with Application

of the Light.

a. General Principles of Concentration of Light.

Since the light as mentioned above is so long about that
kill Bacteria, the first Thought is of course to seek
to reinforce it By the usual Means:
Mirrors or Collectors. By both these ways are
there is, however, the disadvantage that an intolerable arises
strong Heat, a Combustion. But when you know a little
to the Studies on the Effect of Light on Bacteria,
will one know - as it appears from my brief
position in the foregoing - that the warmest rays of light
(the least fragile o: the ultra red, red and orange)
are completely irrelevant to its destructive effects.

ning on Bacteria. An Exclusion of these Rays
will therefore not only be without Harm, but also,
according to the foregoing, be of extraordinary great
share. Such an exclusion of the hottest rays
can also be practiced with ease.

The hottest of the Rays of Light, the ultra-red, is excluded for the most part by letting the Light pass one Water layer ') of suitable thickness (an alum solution is even better, this one I used in the beginning, but gave up using it because of certain technicalities Disadvantages).

If large and strong collector looks or Mirrors, there will Despite the Water layer still be too strong Heat in the Focal Point; man maa der- to seize to exclude the second warmest Rays in The spectrum o: the reds and possibly also the next ones in Row o: the orange and yellow rays. This is possible do by adding a pure blue color to the water, as The light must pass. Blue glass could also be used turn, but I have preferred to dye the water blue, partly because it is so difficult to get blue glass off pure spectrum color, partly - and especially - because you know The use of blue water can vary easily and quickly Degree of color in relation to the intensity of light.

In general, wood is used for this purpose Spectral experiments an ammoniacal solution of sulfuric acid Copper oxide; I also used this in the beginning, but as the liquid was rapidly decolorized by touch with

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') That glass also retains some of the ultra-red rays need not be mentioned here, except in so far as this constantly speaks in favor of using glass lenses rather than mirrors to collect Lvset.

The metal sides of the appliance and otherwise were less comfortable to apply, I have now proceeded to a solution of Methylene sheet. The sulfuric acid copper solution closes, admittedly, when it is sufficiently strong, fully constantly the Red Rays, this makes a strong Methylene-blue solution, on the other hand, does not. On the other hand will one, by a spectroscopic examination of a thin, - seemingly equal in color - Resolution of the two Colors, see that the Methyleneblaat solution swallows more reds Rays than the Copper Vitriol Solution; and since one now in The rule only needs a partial exclusion of the red rays, the methylene blue solution is also off this Reason to prefer. - The Light, as herewith emerges, is of course blue or blue-violet, and after all, this is precisely what is most harmful to bacteria.

Of Light I have used partly Sunlight and partly electric Buelys. The sunlight is of course the most powerful, but then you only have sunlight for the few days of the year Disposition, one must most often resort to artificial light, and of such light is again the electric arc light 1) that which is best suited as it is of Artificial Light to be holds especially many chemical Beams. I'm incensed here a Table 2), which shows how the same Degree of Light, originating from different light source, may be bottom with completely different amounts of chemical clay. The brightness of Frauenhofer's Linie D. is set to 100.

') The electric incandescent light can not be said at all that use here as it contains so relatively few chemical clay. Therefore, when I speak of electric light in the following, I mean, of course, always Buelys.

') Eder: Die chemischen Wirkungen des Lichtes 1891 S. 355.

Brightness in the individual Parts
of the Spectrum.

C.

(redt)

D.

(yellow)

b '

73

100

104

74

100

103

59

100

113

61

100

121

50

100

223

87

100

155

45

100

250

F. •), G
(blue)

Total Brightness
and Normallys

Normally. . .

Gas lamp. . ,

Lime light

Electric light.

Magnesium light.

Moonlight. . .

Sunlight

134

125

285

735

1129

363

2971

1

16

90

362

215

204

70000

Since the absolute difference between sunlight and that electric light 'chemical strength, however, has probably so much interest, I have made a number of measurements with Vogels Photometer to ascertain the Difference. IN October Month, e.g. is the Sunlight c. 8 Times so strongly chemically acting as an electric arc lamp at 25 Amps (at 3/4 Meters Distance from the Arc).
The sunlight measurements were made here in Copenhagen on October 27, 1896 Kl. 1 1 x / 4 in clear skies and in the open Air. The electric light measurements were taken in a stand of 75 Ctm. from the Arc and at an Angle on the coals of c. 45 ° In both cases the photometer glass plate perpendicular to the light rays. And now The chemical power of sunlight for Copenhagen at noon on June 21 is about 6 times so great as the 21st of October, one can make oneself a Concept about the extraordinarily large and electric arc of the Sunlight light 'poor, absolute chemical Power.

To concentrate the Light, I have essentially used collector lenses, partly of glass partly also in the latter

Time of Water: hollow glass lenses filled with water, this
last is the best, but so far it has not been so
easy to obtain good Glass for Roads. Using Heating
the exclusion I have been able to apply so great and strong
Lindser, as it has at all been possible for me to
obtain and though I of course still far from have
reached the limit of what can be provided in this direction,
however, several of the Appliances I currently have are
of very respectable Goodness and Power and well-used
and I will therefore here give a Drawing and Description
of one of them - my best Sunlight.

b. Sollys collector.

This consists, as the accompanying drawing shows, of a metal container
there (Zinc), which at each End is closed with a Collector e al
Glass: the largest of these is plano-convex (however, this is due to it alone
The fact that such was easier to obtain than a double
convex) has a Diameter of 3 "Om. and a Focal Length of 48
Ctm. The container, whose conical shape corresponds to the planar convex
Lindse's Beam Cone, is 40 Ctm. long and closed with a double

convex Lindse at 18 Ctm. 's Diameter and 40 Ctm.'s Focal Length.
The space between the two Lindsers is filled with Water, which is colored with
Methylene sheet. The total device focal length is 30 Ctm. -
The focal length of the lindens is greatly extended due to the water layer.

On the cylinder there are two tubular openings at the top, the
largest of those kept closed with an Outtaper plug is so
large that you can get your hand into the cylinder and clean the glasses
Inside. The second, smaller opening is used for pouring water,
as well as as an outlet for the excess when heated
Water. A sieve apparatus is arranged on the side of the cylinder, in which
by being able to set the Axis of the Apparatus parallel to the Sunbeams.
Theoretically, the Apparatus should still be moved with the Sun o: placed
paa and Heliostat; but in Practice it proves sufficient to set
it every few minutes.

The metal cylinder is at two axes, which allows oblique positions,
brought on a stand with fork; The stand allows offset up and
down, as well as Rotation about a vertical axis. - The setting of the Device
is thus quite simple, and the rest of the use very easy; if you

eg. will affect a small spot, if you give the liquid more blue, you will
affect a larger spot, make it brighter. Burns the Sun strongly,

makes the color more blue, and vice versa if it burns less strongly.

c. Electric Light Collectors.

For electric light, the appliances must be designed differently
than to Sunlight, as the Rays are divergent. Admittedly customer

Collector for Sunlight.

one - as I did in the beginning - use the same kind of Apparates, but then the Lindsers should be more strongly refractory or also placed further apart and far from the arc; but on this one
In this way the light would not be used sufficiently. I have therefore with great advantage used a special construction, which is seen on hosstanding average of my best device for electric light 1). As

i) The collectors are made for me by Mr. Plumber Warberg
Selvtorvet Nr. 6, Copenhagen 0.

you see, it consists of a binocular-like cylinder with 5 ounces,
the first three of these (closest to the Light) have the task of gathering them
diverging rays to a bundle parallel - that is, like the sun's rays.
The last two lindens, between which is blue water, are now gathering these again
parallel Rays and thus corresponds quite closely to the above-mentioned Sunlight
apparatus. The distance between the first three Linds with each other and between

the last two are mutually determined, but of course it is equal valid between these two Systems; here the device is therefore also slidable so that the cylinder can be made long or short at will, which is of great practical importance.

Electric light collector.

The two Linds, which are closest to the Light, are the same (Diameter 1 7 Ctm., Focal length 75 Ctm.), They are with Intent 1) plane convex, with the plane Side towards the Light, and of large Focal Length. The third Lindse is biconvex (Diameter 18 Ctm., Focal length 4, "> Ctm.). The meaning of these three Lindlooks with weak Wrestling rather than a single with strong Wrestling is self-consequently to make more Light pass through, and make it pass through in a more regular way.

Instead of these Lindsers, however, one will certainly be able to benefit use Fresnel Polyzonallinds; I have none of them yet, but waiting to get a pair in the near future.

>) Ievngt I want to draw attention to the fact that Lindsernes Sterrelse og Brændwidth in part has been dependent on what I have had the easiest time obtaining provide, therefore, is no Expression of what I have considered most complete-

comment.

The 4th Undse in the Apparatus is of 18 Ctm.'s Diameter and 45 Ctm.'s Focal Length; the 5th Lindse of 13 l / 2 Ctm.'s Diameter and 32 Ctm.'s Focal Length. Front Lindse's Distance from the Arc (o: front Focal length) is 17 Ctm. Rear Focal Length is 22 Ctm.

The apparatus described here is again mounted on a stand in it the distance of the front focal length from the arc - one must, of course use an arc lamp with fixed focal point - and at an angle with the vertical line (Coals) of about 40 °, as this angle corresponds to the the strongest light effect of the arc. The shape of the Stand, I has used so far, is best seen in the picture at the back of the book. The electric tric Bow lamp hangs in the middle; outside it is placed an Iron Ring, which is carried by 4 Iron supports. The ring has 4 arms and each arm carries one Cylinder that can be moved up and down the arm. At each Lamp 4 patients can be treated.

d. Bacterial experiment with the concentrated blaav iolette Lys.

Before I, however, by my attempts had reached The composition of these is relatively good and strong Appliances, I had at Experiments with Bacteria over-proved to me that the bactericidal ability of light too really increases with its Concentration (this was indeed not in advance absolutely given, compare e.g. The Effect of Many Antiseptics). By these Attempts it turned out that any Improvement of the Appliances had a correspondingly faster killing time of Bakteries to Consequence. . Since it to determine this Time applies to having a uniform yardstick, I have still used the same bacterial form, M. prodigiosus; however, for safety's sake, I have made a few attempts with a Few Other Forms (Typhoid and Anthrax) to check if the effect was the same.

For my experiments I have still used Plate Coaltrips after Buch ners 1) Pattern. How appropriate

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') Buchner 1. c.

these are by Light Experiments, Buchner has shown by beautiful Examples. When pasting a cross with black paper or letters on the side facing the light

The glass plate, the light will not be able to affect them
Kim, who are below, while all Kimene
around being weakened or killed. Place one
now the plate at the appropriate temperature, will after 24 -48
Hours be formed Colonies of the surviving Kim, and
these colonies now form figures which could be seen with
bare eyes, corresponding to the letters affixed.
Buchner lod f. Eks. its Typhus bacilli draw a large
TYPE HOUSE. A Beautiful Experiment With This Method
is to put a photographic Negative over the Culture Board
and then expose to the Light, the bacteria now form, taking
they grow forth, a corresponding Positive, a whole Landscape
f. Ex, as they weaken in their Growth in Relation to
the amount of light passing through the negative (Buchner).

Incidentally, my experimental device was as follows: To
The plate cultures I used Nielsen Bottles, as
Nutrient substrate was soon used KuJpeptone gelatin and
K. P. Agar-Agar in equal parts (Jensens Blanding), soon
exclusively K. P. Agar- Agar (S Kubikctm. in each Fla-
this last Substrate is admittedly less
transparent than the other, but is nevertheless preferable,
because it does not melt or detach from the glass so easily
the wall. In each bottle 2 - 3 Platinum eyelets were sown
a Reindeer Culture in Bouillon. One to a couple of hours after Saa-
n none the Bottle was exposed to the Light.

That, first and foremost, I wanted to know about
these experiments were how big a difference there is in

the concentration of my above-mentioned Apparatus

Treated Light and Ordinary Light (Sunlight or Electric Light).

In Studies with Sunlight, there is always it Disadvantage that there is no question of any constant Strength; for even at the same Sun-height and apparently clear In heaven, the intensity of light is very different due to of varying humidity of the air, richness of dust-particles, etc. v. I easily avoided this Uncertainty my attempts, as I am always on the same day and the same Time exposed one Culture Bottle to the concentrated Solar light and another for the unconcentrated but direct Sunlight.

The cultures, of course, were always quite similar and both Bottles were placed at the same Angle to Light the rays. On each of the bottles was on the culture side glued one of round Holes pierced Paper plate; this paper was black on one side and white on it other. The white Side was facing the Light to prevent excessive heat, whereby the nutrient substrate

could slide on the bottle. Because of the black
Color At the same time, the paper was impermeable to light.
In each of the holes mentioned I now painted on it
Bottle to be exposed to concentrated Light, with
Tush a number which meant that for so long this was to happen
Fields are illuminated: 1 Minute, 3 Minutes, 5 Minutes, etc .; after
The lighting was left in the bottle in the dark and after 24 - 48
The course of hours could clearly be read with the result
naked eyes; the Light had been strong enough to weaken
or kill the bacteria in the specified time, the number entered
namely, forward, formed by Bacterial colonies, which grew in
Shelter from the Black Number. In this way, Bakteries even with Talk the Time it has taken that

kill them. - The Bottle, on the other hand, which was determined
for the unconcentrated light, of course, had to be illuminated
a correspondingly longer Time ('/ 4 - 2 Hours). - I hidputs here a photographic representation of such a
hiking bottle, which - though it is not very good - though
shows how clearly the numbers stand out.

This Method that I still use to
ascertain and check my various Assemblies
The ability to kill bacteria is extremely fine.
branding and gives quite undoubted Results, the
controls itself, taking one of the major Parties of
The plate, which is not illuminated, can see if Saan none
has been good and whether Kimene has been viable.

The number in the middle of the field indicates as said Time, but also,
that it is the Light and not the Heat of the concentrated
Light that has killed the Bacteria. If it was The Heat,
the bacteria below the black number fully as well
succumb as the Glass here becomes particularly strongly
heated. As a rule, one looks for the light effect
a spot without growth, where, where the light has struck the culture,
while in the shelter of the black number has come good
Growth. In the individual cases where, due to
adverse Circumstances The heat has become too strong,
it immediately becomes clear most clearly by the fact that the growth
is inhibited also below the black number.

These experiments obtain both concentrations as with unconcentrated Light not only as Resoltat "killed" or "not killed", but to varying degrees of Weakening straight from an insignificant, temporary Weakening to absolute Death of the Bacteria. It now has by these Very numerous studies have shown that the ready Light kills Bacteria much faster than usual amicable direct sunlight; the best of the Appliances as I currently have, the one pictured above, works, when the light is collected on a spot of just over 2 Ctm. in Diameter about 15 times as strong as ordinary light, so that e.g. three Minutes Effect of it concentrated light weakens the bacteria just as strongly as three Quarters Influence on the Direct Sunlight.

These times are only relative; and the absolute times it was not my intention in these Forseek to do accurate Surveys over. Since it though have a lot of practical Interest, I will give a Few Numbers, which, however, I do not attribute to anyone scientific Value, as I have not made any Light-

measurement. The shortest times I have managed Sunny days in July and August - The experiments performed in Copenhagen at noon - with my best Apparates, is a clear Weakening of the Bacteria after 1 Minutes Influence, so that one has thus been able see Number 1. Absolute Death was obtained by the same Attempts after 5 - 7 Minutes. With the unconscious tertiary light a similar degree of attenuation was obtained after 15 Minutes and absolute Death after c. I 1 / * Hour.

For the electric Light In question are the Conditions clearer, here one has at least a fairly con- constant Light and here one can therefore better speak of abslutte Time indications. I have used for my Experiments and Buelampe paa 25 Amperes (c. 4000 Normallys). The bacterial device was quite as in the experiments with Sunlight. The two Bottles were placed in the same stand from Lysbuen (75 Ctm.), one got Lyset directly from Lysbuen, the other got it from the picture above dede Apparat gathered blue Light (Spot c. 2 Ctm. i Diameter). These experiments showed that Bacteria the effects of the unconcentrated light were visibly weakened after c. In 1 / * Hours Course and killed after 8 - 9 Hours. By the concentrated Light they were visibly weakened after 4-5 minutes and killed after 15-20 Minutes. The device thus amplifies the effect of the light on Bacteria abundantly 20 Times. Devices of this Type, however, also provide something quite excellent especially in relation to my first forms of sensory appliances for electric Light.

The Experimental Results that I have announced here have
of course, in the case of Numbers no permanent
Value. The numbers only mean that to this Point I am

for the time being reached, these figures will by new improvements of
The appliances and at stronger lights quickly become over-
gaaede. The value, on the other hand, lies in the fact that I have demonstrated
a way by which one can achieve a very intense
Effect on the bacteria of the light, and that there is led
Evidence that the bactericidal power of light is still
ger with its Concentration, probably to some extent
proportionally.

Before I leave, however, the Bacteria and the Light
In relation to them, however, I must make the remark
that more Care is much needed
Working in this area. That is, everything
As far as the bacteria are concerned, they are usually very fine and
cozy, but as far as the Light is concerned, is often a lot
deficient. After all, brightness has the greatest significance.
ning. When it comes to direct sunlight, and man
talking about absolute conditions, one should therefore always
give three things: the place (latitude) where the

then was made what time of year and what time

on the day; however, this can make a small difference.

grip on Brightness. The best and only right thing is

of course to make a Light Measurement at the same time

The attempts, but this is never taken in the Literature.

Furthermore, one should mention if it is a Record Culture,

whether the plate has been horizontal or perpendicular

The rays of light, as this can have a lot of significance.

When there is talk of experiments with electric light, can

one sees the peculiarity that the authors do not give up, in which

ken Distance from the Light The culture is placed, and yet know

that the power of light is inversely related to distance

dens Kva drat. By electric Light also has it

Angle of the axis of the coals, under which the culture lies,

much Significance as the Brightness is far stronger at

30 ° - 50 ° than at other Angles.

II. On the Permeability of the Tissues for the Chemicals Rays.

As is well known, the living tissues are completely permeable.
able for the rays of light, the skin, muscles, tendons, nerves,
Cartilage, Bone, everything is translucent; herpaa depends
The diaphanoscopy, which has been so much promised,
but which hardly has the answer to these expectations. One
Exception With regard to Transparency forms
of course the Pigment, as when it is strongly developed
can keep the Light completely out, which incidentally without a doubt
also is the purpose of the skin pigment.

We see examples of the translucency of the weaves
daily; the simplest Experiment is to close the eyes-
the lids to and looking towards the Light; how much Light there
penetrates the eyelids, however, first goes up for
one, when one then covers the eyes with the hand.
One observes daily how easily the Light passes through one
Ear; and when holding the hand with gathered fingers
towards the Light e.g. close to a strong Petroleum
flame, you can see that the fingers are completely penetrated
visible, the only thing you can see drawing are the \ enerne 1),
which appear as dark branched stripes.

The Question That Matters to Us, and That

IN

') Here there is a significant difference between ordinary light and those X-ray Beams; while the blood vessels form the essential Obstacle to the Review of ordinary Light Beams, it is The bone substance that forms the biggest obstacle for the X-ray Rays.

here to be examined is how far the chemical rays penetrate the tissues. I only know one Row Forsearch above, made by Godneff (Russian), but cited prepared by Boubnoff 1). Godneff placed with the help of a Troikart small fused glass tubes with chlorine silver underneath The skin of dogs and cats. Some of these Animals lodged he then stood in the dark, others exposed him directly Sunlight. After an hour he took out the pipes, and it constantly turned out that the Chlorine Silver had been blackened the animals that stood in the sun, but not in those that stood in Darkness.

From these experiments, then, I knew that the chemical At least after a period of time, rays may penetrate nem Huden. Since we now also, as mentioned above, know, that the Presence of Oxygen is necessary to the Light must kill Bacteria, and since the Blood is the most oxygen-containing substance in the tissues, I thought it would be fortunate in causing severe hyperemia in the there of the Skin, which - by my Experiments with Lupus - should be affected by the Light. I therefore spent some time long different means of inducing hyperemia these Places.

But by an Attempt 2), which I one day employed on one ear (of man) it became clear to me that this was hardly the right way. On one side of the ear I made a piece of photographic albumin paper (Aristo-

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') Boubnoff: Archiv f. Hygiene Bd. X S. 335.

') The experiment was carried out on March 26, 1896 at. 3 in Copenhagen by clear Sunshine. Vogel's Photometer showed after 1 Minute Exposure Nr. 15. The collector was formed by a biconvex linden on 18 Ctm.s Diameter and 40 Ctm.s Burn width, The light passed one Layer blue Water of 13 Ctm.s Thickness.

paper) and now let the blue-violet light cone from a solar light-collectors fall on the other side of the ear. After 5 minutes, the paper was not yet loaded. worked. I now took two glass plates and pressed the ear between these, so that it became quite white (bloodless).

and now the Paper after 5 Minutes had passed completely black. Upon continued experimentation, I found that the Paper already after 20 Seconds Course was clearly colored. - This Experiments clearly proved that the blood forms a significant obstacle to the introduction of chemical rays the penetration of the tissues, and that the chemical rays, when The blood is kept away, goes very fast and in proportion

show great Strength through the Skin (by this Experiment with the ear the rays thus passed through two layers of skin and a Layer of Cartilage).

This difference in the transmission of chemical rays walk through a bloody and a bloodless ear, one can

otherwise observe quite directly. If you look in one
Spectroscope through a reasonably bloody Ear, will
one only sees a red stripe; if you now make your ear bloodless,
the spectrum appears to consist of all colors.

After this time I have still strived so well
as possible to keep the Blood away from the Places which
should be affected by the Light. For this purpose I have
let make some printing presses, which consist of
a slightly arched glass plate, which is framed in a
Metal ring carrying 2 or 4 arms. With the help of
Ribbon which is fastened to these arms and tied around
The head, the pressure apparatus is held in place, and then the
they are elastic, an even, constant pressure is exerted.
The following image shows the form and application of these
Pressure glass. The glasses are of different size and soon
flatter soon more vault ede; til Pande og Tinding maa
they be rather flat, until the cheeks strongly arched.

To the nose, these pressure glasses may not work so well.
used, therefore I have shaped some of Glass. I have
for this purpose used Slides, which I have cut pointed in
both ends, then bent over a gas flame
about to hooks for the bands, on which the middle part is bent
in the form of the bridge of the nose, some too flat noses others
too high Noses. In this simple way one gets
Glass that do very well Fillest. The same or
quite similar Glass could be used for the Chin.

'il

In the past, I have now shown how to
can provide for Roads very intensive chemical Light, and
In the case of bacterial experiments, I have shown how
Equally fast this Light is able to kill Bacteria.
In this last section I have pointed out the great disadvantage
which the Blood causes by obstructing the chemical
lers Penetration into the tissues and proven the simplest
Ways to circumvent this disadvantage. Hereby I have
reviewed and significantly improved the two in the beginning
of this Dissertation set out Main Conditions for
the Use of the Light we are dealing with here.

In order that there should not yet be a Mistake
possible, I made another - quite simple, but
very convincing - Try. I took one of mine
Bottles with Plate Culture (as usual with m. Prodigiosus), and placed a long-eared, white Rabbit's Ear
across the bottle, then a stain on the ear was exposed in
3 / i Time for Concentrated Sunlight (the one described above
Collector). It now turned out that the Light after having
passed the ear had partly weakened partly killed the Bacteria
down in the Bottle under the Illuminated Spot. This Attempt
which was made in August about noon,

I only mention one passerby and attribute it as there
certainly does not lack time indication or light measurement
any qualified Value: but I have stated it
partly also to show that it is a way one can go,
if one wants to control the Effect of Light in Depth.

Preliminary Notice of Use
of the Method of Lupus vulgaris.

I have so far only used the Lupus Method,
since this disorder is quite suitable to be
The test vest for a method like this. It is known that
Lupus vulgaris is a bacterial disorder that causes
The tubercle bacillus, it is local and it is in
rather superficially, the three
which I have indicated above as the first
condition for the Application of the Method. Furthermore, by
one that the Light is able to kill the Tubercle Bacillus.
In addition, Lupus vulgaris is a Disease like
often defies all treatment, and that there is thus good here
Need a new and better treatment method.

However, in my attempts to do so, I am still a long way from
from the point where I can make a definite statement on the
tater of this Treatment or about the Absolute of the Method
Value at Lupus; only when I have treated a major
Number of Patients and have had Time to make Observations with

Consideration for Recurrence, which by this Affection after all is
of very special Significance, I will be able to publish

a detailed Report. Since I already have, however
had and has during Treatment a total of 1 1 Patients with
Lupus vulgaris, however, I have had occasion to do
some observations and form me a certain preliminary estimate
on the Effect of Treatment, which I will announce
here. - However, I will first give a Description of the self
The treatment.

Each Pt. is treated two Hours daily, and in
these two Hours become the same little Place (from one
One-ear to a Tokrones Size) illuminated. Usually I
let the same Place be treated several Days until
Weeks in a row. Significantly longer with electric Light than
at Sunlight. The best thing would be that same place
was illuminated even more Hours in a row immediately the first
Gang, so that one might get everything killed in one
Seance; but I have meant that two Hours were already
just enough for the Patients to sit perfectly still (I will
however, note that several of Ptt. has wanted to sit 4
Hours daily). It must then be used as a replacement

Treatment of the same Place several Days in a row 1), but how long, depends on a pure estimate; for unfortunately have there is no stopping point for when the place is illuminated enough. Of course, one should rather act it a little too long than a little too short. - Paa this way the treatment progresses from place to place Place until the entire affected lot has been examined. When it now turns out that a place needs to be renewed Treatment, it is addressed again.

When everything seems to be well treated through,

') I would like to state here that an Investigator, as far as I remember Arloing, has observed that the Descendants - at least in some Led - of Bacteria that have been exposed to Light are clearly weakened.

I consider it best to discontinue the Treatment in one or more months so that it can be seen which Places are adequately lit and which are not. The time is it one este who can decide on the first Treatment is sufficient or one or more Requirements are required

treatments. In certain cases, e.g. where the whole it
soft part of the nose seems to consist of one lupus mass,
however, one can say to oneself that it may be required
even many post-treatments, although the nose
flat has come to look good.

Each Pt. being cared for by an Assistant who has that
make sure that the light is still falling in the same place, and that
it falls perpendicular to the pressure glass.

In this way I have arranged for the time being
The treatment, but it is likely that it will
go different changes as the experience becomes
larger, and Conditions change (stronger Light, better
Appliances). Of course, individuals must also be
dual Considerations.

Since the whole external Arrangement: The Stand and Sense-
the position of the apparatus, the placement of the patients, etc.
is a little difficult to describe, but still has a certain
Interest, I reproduce at the back of the Book two Pictures, of which
one represents the Sun Treatment, the other
with electric Light.

Before I mention the visible effect of this
Light in the sick places, I must first remember them
general effect of chemical rays on healthy skin.
I have given a detailed description of this in a couple of times.
more Dissertations *), to which I refer. That, which

') See the Quotes above.

has the main Interest for us here, is only that
these Rays, when they are sufficiently intense, could
cause an Inflammation of the Various Degrees, from
a simple redness to blistering and severe edema.
This inflammation differs in essential respects
from the one produced by the heat rays.

By the application of the highly concentrated chemical
Rays that I use therefore appear self-
consequently always some blush on the spot and nothing further;
this is the Rule; but the Intensity of Light and individual
Incidentally, differences play a major role.
Sometimes Leakage of Liquid or Forming
of fluid-filled blisters with subsequent crusting
formation. A few times have in addition to Inflammation
of the Place itself been edema of the Surroundings, and a Par
Sometimes I have even seen Necrosis with 2 - 3 mm. deep
Loss of substance of the treated site; but in these last

Cases have been about a clean Combustion.

In this Treatment no one is really formed
Year. If a Place is adequately treated, it will be
less red than before, and Instead of that before
especially with the Randene, rose slightly above the
giving skin, it now becomes flat, and gradually as
Time goes by, it is - in the few cases I have so far
observed - more and more come to look normal
Skin. If crusts have formed, the skin shows
themselves by their waste as a rule rather pale and of natural
Appearance, but only after some time one can see if
this is of greater duration or only transient. IN
the very individual Cases where, as mentioned, have
been Substance loss, comes there without a doubt Ar.
However, these cases should be avoided, and probably could also be avoided

as a rule avoided; they are almost due to the fact that Pt. is
for taps and the appliance has charged too much heat
get through.

The propensity for recidivism under this
action I can not yet have anyone justified

Opinion. Only for two Cases is there
has been so long that there has been an opportunity to
make observations on this, but in both cases ceased
The patients with the Treatment before I wanted it.
The one Pt. (Mr. Engineer N. M., Lupus for 8 Years, Great Partier of one cheek attacked, treated earlier on
all possible ways) had been treated from 20 Nov.
1895 to in March 1896 one to two Hours daily with electrical Light (20 Amperes Lamp and a rather primitive
and weak Apparatus). When he stopped the treatment
- because he considered himself healed and not
had time to keep going - was not there yet
so quite a bit, which in my opinion needed to
further processing; but now by Inspection at the End
of Oct. d. A. it seems as if there is only one Spot
on the size of a small pea, which is "alive," and which
needs Treatment. - The other Pt. (Commercial
kommis M., who had a 6-year-old, 5-øre large Lupus spot
on one cheek) was treated well half a dozen
Times in March and April d. A. with Sunlight; ham beI thought even less as finished when he
discontinued the Treatment. By Inspection These Days
(Beginning of Nov.) it turns out that there is still one
Lupus spot, but it is almost half as big as before
(after Comparison with Photography).

The issue of recidivism is, of course, the most important
in the case of a Lupus Treatment Method,

and the two cases concerned here cannot be concluded a lot of; but there is a Moment which speaks for that one could hope specifically by this method to avoid hyp-Girl Relapses. This is an easy matter Method - and I place special emphasis on that - that they seemingly healthy but possibly infested donations be treated at the same time as the sick Place.

With regard to my 1 1 Cases') I still have to note that they are all old cases of affections of very different Distribution. They all have in the past have been treated in the most diverse ways. That the youngest of the cases has lasted for 5 years, the oldest for 2 1 Aar, the others lie in between. As you can see. is it a Crowd of Veterans, and the Treatment of them is one hard, but in return reliable test for the method.

If one possible customer think that my Opinions whether the effect of this treatment is too specific in Considering that I have only had 11 Cases, I will note that this would be quite right, so-forward it was about an internal Medicine, a Injection el. similar, of which one expects one

General effect. But here the treatment is purely local, Place by Place is treated and you can e.g. in one and same Pt. observe the same effect a half Sn <^ Times or more. By the general Treatment is each Pt. however, only one Example. The reason I in

') In addition to these 11 Cases of lupus vulgaris I have treated two Cases of lupus erythematosus. but the effect of the light has not here proved so decidedly different from the effect of lupus vulgaris that there has been occasion to get closer herpaa. But by the way, I make all reservations about this Questions until I have gained greater experience.

this Dissertation does not give a detailed Presentation accompanied by medical histories, depends, as has been said, on fact that I can say nothing about it very-main point, the recidivists.

It remains to be mentioned the disadvantages of this

Treatment method. First of all, there are self- consequently, that one can only affect the places where The light can come on; so not Affections of the Nasal the cave, the oral cavity and the ear canal; furthermore, they will Ste Environments of the eye may be difficult to treat. Deep affections will also present a part Difficulty. But what is the main Disadvantage, is the duration of the treatment, both for the individual Seancers as for the whole Period, as well as that it often takes a long time before one can observe Results of the Treatment. It is therefore required first and above all Patience in the Patients, but this Trait has also been amazingly developed in them most lupus patients, especially when they see that it is going well forward, although it is probably so small.

In quite a few cases where the Affection is much widespread and growing rapidly, the long-term treatment of could, moreover, cause one not to keep Trit with the Plant. I thus have one of my patients had to give up treating for the time being - until I gets stronger luminosity - as the result of several neders Treatment had only been to keep the Growth roughly in Chess.

But this longevity and the fluids thereof Disadvantages are, as one should well remember, not something that

is a Consequence of the Method itself, but is dependent on it
used Light Power (Light + Sensory Devices). By it
Light power that I have used so far (25 Amperes Lamps
and collectors which amplify the effect of light on
Bacteria c. 20 times), the treatment is so long-lasting,
that I would not advise anyone to try Treatment of
Lupus with weaker Power '). I call this Power
weak, for here, where a whole new Application applies
of the light, one must also use a new yardstick for
The luminosity. When there is talk of lighting, one will
say that a 23 Amperes Lamp is a very strong
Lamp; but when there is talk of killing bacteria,
one must say that it is a very dim lamp, taking it
namely, as mentioned above, is 8 - 9 Hours to kill
Bacteria, which are even located very close to the Light,
3/4 Meter from Lysbuen. A Lamp, as under the same
Conditions could kill Bacteria e.g. in the course of a
Hour, one could better call a strong Lamp.

A judgment of the method, at present
Position, therefore, would be quite incorrect. Before
experiments have been made with very strong light and they
best possible Apparatus, one will not be able to form
any particular opinion as to its real value. -

By this I do not mean, however, that there can be any
Doubt that the stronger Light and the better Appliances
will give far more excellent results than the present ones;
for what an increase of luminosity has to say, has

') Admittedly, my previously mentioned verstc Pt., Hr. Engineer M.,
was treated with much weaker luminosity and yet remained so
almost completely healthy, but the treatment also lasted about 5 months.
With the luminosity I now use, I would assume that
the same customer is done a lot faster.

I, as previously affected, not only convinced myself
by bacterial experiments, but also in the most obvious
taken by the very Treatment of Lupus; I but is only,
that the Degree of Improvement cannot be specified definitively, before
such attempts have been made.

Such an increase in luminosity is partly one
technically, but especially an economic Question, thi
with the technical aids available to the present,
one will be able to reach exceedingly far.

The increase in luminosity will be possible through more Roads, and in which Directions I shall specify.

1) Reinforcement of the Light. The only kind artificial lights, which there may well be talk of at the moment to use for our Use, is the electric Buelys, and it will be an easy matter to obtain far stronger Light than what I have used 1). The intensity of the arc light is dependent of the electric current, and the power of the arc lamp is therefore commonly given in Amperes, this Indication of Strength does not, however, quite correspond to the Indication in Normallys, as The brightness does not increase in parallel with the current (led, for example, that a 5 Amperes Lamp is at 500 Normally Light Strength, and 10 Amperes at 1,100 Normal Light and a 20 Amperes Lamp of 3000 Normal Lights). - Very strong Buelys is used for the Light Projectors, which is used on forts and large warships; but even stronger Light, probably the strongest one surpassed head uses, used by the electric Lighthouse; one English lighthouse thus has an electric arc lamp of 250 Amperes.

') I must note here that I have the prospect of getting in the near future Lamper paa 80 Amperes

However, since there is Opportunity to manufacture yet much stronger Light than this, it will be clear that The limit here must be set by the force exerted by eco- economic reasons can provide. From the Method Side there is hardly anything in the Way of applying even the strongest possible Light, it would only be an Advantage; for where strong The light than stays, one will always easily be able to exclude any troublesome Heat. The chemical Luminance would also hardly be able to become too strong: if it became very strong, the consequence would only be that one could settle for a short-term Treatment.

2) Improving the Quality of Light. The al- amicable electric arc lights are of course intended for to give as strong "light" as possible, and then the yellow ones and green rays are the most luminous, they have chosen Flektroder, which gives especially many of this Kind Rays. For our Use, however, which is often spoken, the Light best, which contains the most chemical Rays, and such light there is opportunity to produce. According Kaad og Anvisning, som jeg har faaet af Hr. Professor la Cour in Askov, and as I am very grateful to him for, I have made some Attempts to place burnt Lime in the positive electrode. I drilled the soft one

The graphite vessels in the coals came out and then filled the hole with them
a mixture of burnt lime and the extracted graphite in
different Conditions. By a Mixture of '/ * Lime ° g 3 / *
Graphite produces a beautiful violet light, at the same time
the arc becomes longer, which has the advantage that
The coals do not burn together. The positive electrode
glows quite a bit weaker and especially to a lesser extent
than otherwise. By Experimenting with Photographic Silver Paper
at the same definite Distance from the Light it turned out that

The paper by Light from the calcareous Arc was stained
more than twice as fast as usual
Light. Unfortunately, this difference did not emerge at all
or rather went in the opposite direction by the same kind
Try the light after it has passed through mine
Collectors. I suppose the reason must be sought
in that the Kalklyset has contained particularly many ultraviolet rays, which were then absorbed by the
many glass lenses which the light had to pass; Glass
namely, absorbs highly ultraviolet rays,
while Water lets them pass. - A Mixture of 1 / s
Lime and 7/8 Graphite proved more fortunate; but otherwise
I can say nothing definite since my Attempts at this

have been few and far between. I just wanted to communicate to them to enable others to evoke and luckier Attempts; for this is almost a task for Physicists; and the Physicist who could find some Electrodes which amplified the light skilfully in the blue and Violette Straalers Gebet, and which was also easy to use just and not too expensive, he would make himself very served by this Case.

3) Improvement of the Collectors. The first and foremost Improvement of Collectors for Sunlight will be to replace the Glass Lenses with Waterlindser. I owe this excellent idea to Mr. Engineer Niels Mogensen. The water lenses are formed by framing two after a spherical surface curved glass plates in a metal or Threading, through an opening in the rim you can then fill those with Water. These water lenses have many parts rather than glass lenses, they could be manufactured in considerable larger Dimensions, they absorb fewer chemical Rays and far more heat rays than these, and they are infinite

much cheaper "1 cheaper. Since one has not used so far that kind of Hullindser, it is not possible to say where

store m an can manufacture them; but after Manufacturing
judging by the way of the glasses, one would think that one
had to be able to achieve a size of 1 meter in diameter
or more.

When Using Very Large Satellite Mirrors, As
in such a case - to be free from the heat -
had to combine with a Lindsea apparatus with blue water,
would one be able to obtain a colossal chemical luminosity;
for Sunlight is in itself - in Relation to Artificial Light -
so extraordinarily powerful and rich in chemical rays,
and Hole mirrors of Metal or other Material one will
could produce in the largest Dimensions.

With regard to Electric Light Collectors is
(»The ruffles much narrower. The Appliances I have
constructed, ere, as soon as they are supplied with
Fresnelske Lindser, very close to the border for what
which can be reached, since they take away almost all the light
The lamps. If you want to settle for two Appliances by
each Lamp, instead of four, which I use, will
one could of course make the Apparatus somewhat stronger,
but not very much. - The Improvements That Could
is done in this area, concerns mainly the Lindserne;
it's about getting them made of glass types, like
particularly easily allow chemical rays to pass through; the best
will, however, probably be as far as possible to use Water-
lindser. - • Furthermore, one would like to reinforce
The light by placing hollow mirrors on the opposite side

of the Arc; but Experience shows unfortunately - according to
Information that I owe Mr. Fyrdirektør Ravn, -

that such mirrors (o: metal mirrors) are quickly destroyed by
the Ozone evolved by the Electric Light.

I have dealt with these improvements in luminosity
pretty detailed to show how much can
done and what can be done. In addition to those mentioned here
even more improvements are conceivable,
in particular, it is possible to find even more
intense Light forms than the Arc Light. But already now, with
the available means, one will be able to achieve much
widely.

In this Preparation of the Application of the Method
I only stuck to the treatment of lupus,
for the good reason that so far I have only tried
toden by this Disease. This is partly due to the fact that
so many patients with lupus have wanted to
throw themselves this treatment, but especially on that I

has meant it really not to spread the Forces too much
and would like to provide me with a fairly reliable
personal Impression of the Effect of Treatment by this
Affection before proceeding with Attempts by others
Skin disorders.

Above, I have repeatedly determined points-
right Method Range and Limitation, namely, that
a disorder must be local, superficial and bacterial
riel for the Method to be suitable for it. Hertil maa
of course, as something self-evident, is added „for the Light
available ", as this is basically not in the Word
“Superficial.” Furthermore, of course, one will not do
Try this method for disorders that one can
heal easier and faster in other ways. To

Despite these limitations, the area of
to be large enough and before reaching the Clear
where it should be used and where not
a great deal of work is being done and it will be a long time.

When I have talked about the method so far, I have almost
thought of the application of a moderate luminosity. But

I am, of course, not blind to the possibility that Me-
toden may be able to benefit even by Affections,
which could not be called superficial, in case one wanted
apply an extraordinarily large luminosity; and what I
understands hereby will have emerged from the foregoing.
In any case, such attempts would be numerous
interesting. The results, however, would be fully so
much as of the luminosity be dependent on the Possibility
of making the Tissue or Blood in question
poor. As an example of what one might think
suitable for such experiments, I will mention tuberculous
Disorders of the small joints of the extremities of the minor
Children. Firstly, such child extremists are
teter like extraordinary pellucid, and secondly
it would be easy for an Esmarchs Sling to make Par-
tiet fairly bloodless.

For the practical side of the matter one must
however, do not forget the scientific. Through
of my apparatus one gets a light of a hitherto unknown
chemical Intensity, and the Effect of it is known
of course not. Our Knowledge of the Effect of Light
on Bacteria has - notwithstanding the existence of a
proper large amount of surveys - still a lot
uncertain about himself. There will therefore be every occasion for
to take up these investigations anew, for with this

strong light, such studies will be relative light and fast executed.

Furthermore, it will be of much interest as well to test the effect of this light on fungi and others "Micro" organisms. Furthermore, on fetal development; on fetal movements in frogs and salamanders; on The skin (the normal e Hud); paa Blodlegemerne o. s. v. in other words, wherever one already knows one Effect of the Chemical Rays of Light. For there is al Reason to expect that with this intense Light will get strong and unambiguous results where you have so far has had weak and hardly noticeable effects. This the latter must be assumed to be the reason why they The effect of chemical rays on the organism so far has been so little known and so little noticed.

How Great an Importance these so-called chemical Rays have for the animal organism, is more and more dawned on me during my work with and under-research on the effects of light, and I hope so, that this Method will contribute its to arouse Interest for these rays, so that both science will absorb them for closer Examination and the Practical Medicine will make use of the Power inherent in them.